REMARKS

Claims 1 to 18 and 20 to 29 are now in the application, with claims 1, 4, 7, 11 and 14 being the independent claims. Reconsideration and further examination are respectfully requested.

Objection was made to Figures 1 and 2 because the boxes are not labeled in Figure 2 and the terminals are not labeled in Figures 1 and 2. In response, Applicant submits herewith a Request for Approval of Drawing Changes, which labels the boxes in Figure 2. As to the terminals, those terminals merely are input and output terminals for the illustrated boxes. As a result, no meaningful labels could be attached to those terminals. In addition, it is noted that 37 C.F.R. §41.81(o) and MPEP §608.02 require that the drawings contain as few words as possible. Based on the accompanying Request for Approval of Drawing Changes and these rules, withdrawal of this objection is respectfully requested.

Objection was made to claims 2, 3, 5 to 10, 12, 13 and 15 to 18 for beginning with the word "A" or "An." However, it is noted that the MPEP clearly permits dependent claims to begin with the word "A" or "An." For example, MPEP §608.01(n) lists, as examples of acceptable multiple dependent claim wording, a number of dependent claims that begin with "A". Accordingly, withdrawal of this rejection is respectfully requested.

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Claims 1 to 19 were rejected under 35 U.S.C. § 112, first paragraph. In response, Applicant has amended the claims to more clearly recite the present invention. Specifically, the independent claims have been amended to clarify that the outputs of the circuits include a component which is a function of an input signal and also include a noise component resulting from noise experienced by the circuit. In addition, claim 7 has been amended to clarify that the signal input to the second circuit is the inverse of the signal input to the first circuit. This can be easily accomplished by using an inverter, as is well known in the art. Accordingly, withdrawal of this rejection is respectfully requested.

Claims 1 to 19 were rejected under 35 U.S.C. § 112, second paragraph, on various grounds. The specific rejections are discussed below in the same order in which they were discussed in the Office Action.

Claim 1 has been amended to clarify that the function is the normal function of the circuit which is performed on an input signal to produce an output signal. The claim also has been amended to indicate that the noise component of the output results from noise experienced by the circuit, such as environmental electromagnetic noise, and that the noise component of the second circuit is approximately equal to the noise component of the first circuit. This can can be achieved, for example, by using similar components in the first and second circuits and by placing the first and second circuits close enough together that they experience same environmental noise, as

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described in the specification. Similar amendments have been made for claims 4 and 7.

Claims 3, 8, 14 and 18 have been amended above to indicate that the halving circuit reduces a signal by one-half its amplitude. In addition, it is noted that those claims recite that the subtractor circuit comprises (or includes) a halving circuit, and not that the subtractor circuit is a halving circuit.

Claim 4 has been amended to eliminate the word "designed."

Claim 11 has been amended to clarify that the noise canceling circuit processes the output signals of the analog circuits with the noise signal to reduce the noise component. As described in the specification, in the preferred embodiment, this processing involves merely subtracting the noise signal from the outputs of each of the analog circuits. In the preferred embodiment, the analog circuits are 20, 22 and 28, and the noise canceling circuit is analog noise canceling circuit 24, all as shown in Figure 2. The recitation of a digital circuit has been deleted from claim 11.

In claim 10, the "operator circuit" has been changed to the "third circuit".

With regard to claim 14, it is noted that this claim is a method claim. Accordingly, it is not necessary to specify structure to perform the individual steps. In addition, claim 14 has been amended to refer to a "null output" rather than to a "null signal". "Null output" is defined at page 5, lines 11 to 17, in the specification. Claim 19 has been canceled above, without prejudice or disclaimer of subject matter. It is

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unclear how the comments made in the Office Action with respect to claim 14 also apply to claim 18.

Finally, claim 17 has been amended to recite "an added output", thereby providing the requisite antecedent basis for claim 18.

In view of the foregoing amendments, withdrawal of the § 112, second paragraph, rejections is respectfully requested.

Claims 1 to 19 were rejected 35 U.S.C. § 102(b) over U.S. Patent 5,546,458 (Iwami).[1] Withdrawal of this rejection is respectfully requested for the following reasons.

In one aspect, the present invention provides noise cancellation, by utilizing a second circuit having a noise component which is approximately equal to a noise component of the first circuit, where the noise components results from noise experienced by the first and second circuits, and by subtracting the output of the second circuit from the output of the first circuit. By virtue of this arrangement, the present invention often can significantly reduce noise effects. This invention has particular application in mixed signal integrated circuits, in which digital and analog circuits are combined on the same chip.

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[1] It is assumed that the Examiner intended to reject under 35 U.S.C. § 102(e), as the present application was filed within one year after the date of the Iwami patent.

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Thus, independent claim 1 is directed to a circuit which includes a first circuit, a second circuit and a subtractor circuit. The first circuit has a first input and a first output, which includes a function of a signal at the first input and also includes a first noise component resulting from noise experienced by the first circuit. The second circuit, is located proximal to the first circuit and has a second input and a second output, the second output including a function of a signal at the second input and also including a second noise component resulting from noise experienced by the second circuit. It is a feature of this aspect of the invention that the second noise component is approximately equal to the first noise component. The subtractor circuit is connected to the first circuit and to the second circuit and subtracts the second output from the first output.

Independent claim 4 is directed to a circuit that includes first, second and third circuits. The first circuit has a first input and a first output, the first output including a function of a signal at the first input and also including a first noise component resulting from noise experienced by the first circuit. The second circuit has a second input and a second output, the second output including an input signal component which is a function of a signal at the second input and also including a second noise component resulting from noise experienced by the second circuit, the input signal component being a null output, and the second noise component being approximately equal to the first noise component. The third circuit has a third input connected to the

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first output and a fourth input connected to the second output to subtract the second output from the first output.

Independent claim 11 is directed to an integrated circuit chip (IC) that includes a plurality of analog circuits, each proximal to each other, and each of the plurality of analog circuits producing an output signal which includes a function of an input signal and also includes a noise component resulting from noise experienced by the plurality of analog circuits. A noise separator circuit, proximal to the plurality of analog circuits, produces a noise signal based on noise experienced by the noise separator circuit, the noise signal being approximately equal to the noise component of the output signal output by each of the plurality of analog circuits. A noise canceling circuit processes the output signals with the noise signal to reduce the noise component of the output signal output by each of the plurality of analog circuits.

Independent claim 14 is directed to a noise cancellation method. According to this method, a first signal is supplied to a first circuit, and a first output is read from the first circuit. A signal is supplied to a second circuit which results in a null output from the second circuit, the second circuit being located proximal to the first circuit, and a second output is read from the second circuit. The first output is then combined with the second output to produce a combinational output, the noise component of the first output due to noise experienced by the first circuit being

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approximately equal to the noise component of the second circuit due to noise experienced by the second circuit.

The foregoing combinations of features are not understood to be disclosed or suggested by the applied art. In particular, Iwami is not seen to disclose or to suggest at least the feature of subtracting the output of a second circuit from the output of the first circuit, where a noise signal resulting from noise experienced by the second circuit is approximately equal to the noise signal resulting from noise experienced by the first circuit.

In this regard, Iwami is directed to a hands-free communication apparatus for combining inputs from two or more different microphones. In an attempt to simultaneously reduce noise, Iwami subtracts the input of one microphone from the input of another microphone, rather than adding the inputs from the two different microphones. Thus, Iwami is different from the present invention in at least the following respects.

First, in Iwami the noise is input along with the input signal (i.e., the audio signal). Accordingly, Iwami says nothing at all about a noise components resulting from noise experienced by a circuit, much less about a noise component from a second circuit being approximately equal to a noise component from a first circuit. This difference is believed to be significant because, for example, the techniques for insuring that input noise signals are the same (as in Iwami) generally will be different than

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techniques to insure that two circuits experience the same noise (as in the present invention).

In addition, in the present invention the noise component of the second circuit is approximately equalt to the noise component of the first circuit, so that significant noise reduction can be accomplished by subtracting the output of the second circuit from the output of the first circuit. However, even assuming that Iwami's input noise signals are equivalent to the noise experienced by the circuits in the present invention, which Applicant does not concede, it appears that Iwami's input noise signals generally will not be approximately equal to each other.

This is clearly seen in Iwami's preferred placement of the microphones. Specifically, in column 4, lines 25 to 34, Iwami notes that:

> ". . . two microphones are arranged separate from each other so as to allow simultaneous communication by a plurality of persons in the same vehicles . . . For example, one of the two microphones may be disposed on the driver's seat, and the other on the passenger seat. Preferably, one is disposed on the front seat and the other on the back seat."

The foregoing quotation from Iwami indicates that Iwami intends that the microphones will be placed at least a foot apart. In fact, since Iwami's main purpose is to input audio signals from different locations with an automobile, it probably would not make sense to place the microphones closer than one foot apart. Otherwise, the

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microphones most likely would pick up roughly the same speech signals, resulting in the same problems described by Iwami in his "Description of the Related Art".

However, separating the microphones in this manner generally also means that the noise received by the microphones will be different. In this regard it is noted that audio signals have two components, amplitude and phase. Thus, in order for two noise signals to be approximately equal, they must be approximately equal in both amplitude and phase. However, it is noted that sound waves have frequencies between 20 and 20,000 vibrations per second, and the speed of sound is approximately 1,100 feet per second.[2] Accordingly, the wavelength of most audio signals will be smaller than one foot. The only exception to this will be the very low frequency sounds (i.e., those below approximately 1,100 hertz). As a result, separating microphones even a fraction of a foot can result in a significant phase difference in the noise received by two different microphones.

However, because Iwami indicates that his preferred placement of the microphones is at least one foot apart, the noise received at Iwami's microphones generally will not be approximately equal to each other, and therefore any noise reduction achieved by Iwami's technique generally will not be substantial. In fact, in certain cases where the noise signals are significantly out of phase (such as by 180

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[2]See the attached pages taken from the Columbia Encyclopedia, Fifth Edition, which pages were downloaded from infoplease.com.

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degrees), Iwami's technique will actually increase the amount of noise. This shortcoming is inherent in Iwami's technique because Iwami's main goal is to provide audio inputs from different locations.

Iwami apparently recognizes this fact by suggesting in column 5, lines 47 to 50. In this portion of Iwami, it is noted that ". . . the action of the microphone not required to pickup sound can be switched off to reduce unwanted sounds and therefore to improve the articulation of target speech." It is noted that if Iwami believed that the audio noise signals provided at the two microphones were approximately equal to each other, then there would have been no rationale for including this paragraph in his disclosure. That is, if the two noise signals were in fact approximately equal to each other, than it would always be best to leave the second microphone on and to subtract the signal from the second microphone from the signal from the first microphone, in order to eliminate noise. Because Iwami recommends to the contrary, the input noise signals could not be approximately equal to each other.

Thus, Iwami would not have disclosed or suggested using a second circuit that has a noise component resulting from noise experienced by the second circuit which is approximately equal to the noise component from noise experienced by a first circuit. In addition, the foregoing independent claims include other features which are not disclosed or suggested by Iwami. For instance, claim 4 recites that the input signal component of the second circuit is a null output (which is defined on page 5, lines 11 to

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17 of the specification). Nowhere is Iwami seen to disclose or to suggest this feature of the invention.

Accordingly, independent claims 1, 4, 11 and 14 are believed to be allowable over the applied art.

Independent claim 7 concerns a circuit in which a second circuit receives the inverse of a signal input to a first circuit, and the output of the second circuit is subtracted from the output of the first circuit. By virtue of this arrangement, significant noise reduction often can be accomplished, as described in detail in the specification.

Thus, independent claim 7 is directed to a circuit that includes a first circuit having a first input and a first output, the first output including a function of a signal at the first input and also including a noise component resulting from noise experienced by the first circuit. A second circuit has a second input and a second output. A signal supplying circuit supplies to the second input a signal an inverse of the signal at the first input. A third circuit has a third input connected to the first output and a fourth input connected to the second output, and subtracts the second output from the first output.

Iwami is not understood to disclose or to suggest the foregoing combination of features. In particular, Iwami is not understood to disclose or to suggest at least the feature of supplying a signal to a second circuit which is the inverse of the

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signal applied to a first circuit, and then subtracting the output of the second circuit from the output of the first circuit.

Accordingly, independent claim 7 is believed to be allowable over the applied art.

The other claims in this application depend from the independent claims discussed above, and therefore are believed to be allowable for at least the same reasons. Because each dependent claim also defines an additional aspect of the invention, however, the individual reconsideration of each on its own merits is respectfully requested. For instance, dependent claims 21, 26, 28 and 29 recite that the noise is environmental electromagnetic noise. Also, dependent claims 6 and 10 recite that the various circuits are on a single integrated circuit chip. Nowhere is Iwami seen to disclose or to suggest these features of the present invention.

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In view of the foregoing remarks, it is believed that the entire application is in condition for allowance, and an indication to that effect is respectfully requested at the Examiner's earliest convenience.

Respectfully submitted,
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